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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/072,907	02/12/2002	Soo Seok Choi	1567.1022	3556

49455 7590 02/12/2007  
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EXAMINER
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ALEJANDRO, RAYMOND

ART UNIT	PAPER NUMBER
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1745

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/12/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/072,907

Applicant(s)

CHOI ET AL.

Examiner

Raymond Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 January 2007.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4,8,9,17 and 29-46 is/are pending in the application.  
4a) Of the above claim(s) 29-37 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-4,8,9,17 and 38-46 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 02/12/02, 07/27/05 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Amendment***

This office action is responsive to the amendment filed on 01/16/07. The applicant has overcome the 35 USC 112 rejection and the 35 USC 103 rejection. Refer to the abovementioned amendment for substance of applicant's rebuttal arguments and remarks. However, the present claims (including new claims 40-46) are finally rejected over a new ground of rejection including a newly discovered reference as set forth hereinbelow and for the reasons of record:

### ***Claim Disposition***

1. In sum, claims 10-16 and 18-28 have been cancelled. Claims 29-37 have been withdrawn from further consideration.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-4, 8-9, 17 and 38-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moss et al 3532543 in view of the Japanese publication JP 47-028431 (herein called "*the JP'431 publication*"- See English translation provided in a prior office action).

The present claims are drawn to a lithium-sulfur battery wherein the disclosed inventive concept comprises the specific positive electrode.

As to claims 1 and 4:

Moss et al disclose a lithium-sulfur battery (TITLE/COL 1, line 20 or line 25 or lines 44-50/ COL 3, line 27) comprising a cathode configuration employing sulfur (*elemental sulfur*) in combination with a porous carbon cloth structure (*applicant's porous material*) upon which the active cathode material which may be either sulfur or a mixture of sulfur and a cathode composition including conductive carbon and a suitable binder such as polyvinylchloride have been applied (COL 2, lines 35-50). Moss et al emphasize that the preferred cathode configuration uses a porous carbon cloth structure; otherwise if the resulting structure is not porous enough, good electrolyte penetration is not obtained (COL 2, lines 38-45).

The active cathode ingredients are preferably applied to the carbon cloth support. In one manner of application of active ingredients to the carbon cloth support, a coating dispersion including powdered sulphur and powdered carbon black and methylene chloride-carbon disulfide carrier containing polyvinylchloride resin is sprayed or dropped onto the carbon cloth support creating an electrode which is ready for use in the cell (COL 2, lines 51-63). *In this case, the porous carbon cloth structure can also serve as the current collector.*

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The negative electrode material is made of lithium metal (COL 2, lines 65 to COL 3, lines 3). A separator is used (COL 3, lines 4-7), and an electrolyte solution including solvents and a lithium salt (COL 1, line 30/ CLAIM 1). *Thus, the battery cell has a separator and an ion-conducting electrolyte.*

As to claims 4, 8, 40 and 42-44:

*Furthermore, as to the method limitation, i.e. i) mixing (ball mill), ii) coating, iii) removing, iv) injecting, v) employment of a plasticizer and its removing solvent and the likes, it is further noted that a method limitation incorporated into a product claim does not patentable distinguish the product because what is given patentably consideration is the product itself and not the manner in which the product was made. Therefore, the patentability of a product is independent of how it was made. In this regard, it is thus noted that since the plasticizer is removed from the positive electrode, the plasticizer and the removing solvent are not an active constituent of said positive electrode. That is, the plasticizer and the removing solvent were just employed as part of the preparation technique but the plasticizer was removed thereafter by using the solvent. Further, since the porosity of the positive electrode as claimed also includes "0 (zero) porosity" or "a pore-free material", it is hence asserted that no plasticizer and removing solvent is required.*

As to claim 9:

Moss et al discuss the formation of polysulfide materials (COL 4, lines 35-40).

As to claim 17:

Moss et al disclose the use of at least ethylene carbonate, propylene carbonate and butyrolactone (CLAIM 1/ COL 2, lines 1-7).

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As to claims 38-39:

Moss et al provides a porous solid separator material such as polyethylene filter paper being porous and placed between the anode and the cathode (COL 3, lines 4-13). An electrolyte solution including solvents and a lithium salt is used (COL 1, line 30/ CLAIM 1). *It is noted that the separator functions as a solid electrolyte supporting the electrolytic solution.*

As to claim 40:

The cathode material is made of a powdered sulfur (COL 1, line 55/COL 2, line 45/ COL 2, line 53-54/ Col 3, line 27/ COL 3, line 41/ COL 3, line 55). *Thus, Moss et al implicitly make reference to elemental sulfur.*

As to claim 45:

Moss et al disclose the use of a suitable binder such as polyvinylchloride (COL 2, lines 35-50).

As to claim 46:

Moss et al disclose that the anode, the cathode and the separator are cut into elongated strips which are rolled (COL 3, lines 35-37). *In this case, the porous carbon cloth structure of the cathode configuration can also serve as the current collector.*

Moss et al disclose a lithium-sulfur battery in accordance with the foregoing teachings. However, the preceding prior art reference fails to expressly disclose the specific pore size of positive active material (i.e. *the pore size of the porous carbon cloth structure*).

As to claims 1-3:

The JP'431 publication discloses a sodium-sulfur secondary battery wherein an electrode comprising a porous carbon cloth contained therein sulfur active material (See Translation of

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JP'431 at page 2, lines 4-5, or line 10, or line 14/ EMBODIMENT 1/ EMBODIMENT 7). The JP'431 discloses specific embodiments wherein the porous carbon cloth material of the disclosed electrode exhibits an average pore size of 10-1000  $\mu\text{m}$  (See Abstract/EMBODIMENTS 1-7).

(*Emphasis supplied* →) Specifically, EMBODIMENT 7 shows a porous carbon cloth material with a pore diameter of 8  $\mu\text{m}$ ; and EMBODIMENT 1 also shows an average pore diameter of 20  $\mu\text{m}$  for the porous carbon cloth material.

*Thus, the JP'431 shows a pore diameter with sufficient specificity; and an average pore diameter sufficiently close to the claimed range. Additionally, the exemplified average pore diameters disclosed in JP'431 (20 $\mu\text{m}$ - Embodiment 1; 240 $\mu\text{m}$ - Embodiment 1; 350  $\mu\text{m}$ - Embodiment 2; 170  $\mu\text{m}$ - Embodiment 3) suggest the suitability of selecting any average pore diameter within the lower end of the entire disclosed range of 10-1000  $\mu\text{m}$ . Simply, the JP'431 does not disclose, teach or suggest to select an average pore diameter higher than 350  $\mu\text{m}$  and/or a pore size greater than 200  $\mu\text{m}$ . Consequently, it is reasonable to conclude that the JP'431 at once envisages using an average pore size closer to the lower end of the disclosed range, namely, JP'431 at once envisages selecting an average pore size closer to 10  $\mu\text{m}$ . Stated alternatively, working embodiments of the JP'431 show preferences for average pore sizes and/or pore sizes lower than 350  $\mu\text{m}$  and/or 200  $\mu\text{m}$ , respectively.*

The JP'431 discloses that the sulfur is an electric insulator so that it is necessary to increase conductivity of the sulphur to react electrochemically in the battery (ABSTRACT). It is disclosed that it is essential to use a porous conductor consisting of a material having a degree of porosity with pore diameters of 10-1000  $\mu\text{m}$  as a cathode member to increase the conductivity of the cathode (ABSTRACT).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to make Moss et al's positive active material by having the specific pore size of the JP'431's positive active material (i.e. *the pore size of the porous carbon cloth structure*) because the JP'431 publication reveals that in battery system using sulfur it is essential to use a porous conductor consisting of a material having a degree of porosity with pore diameters of 10-1000  $\mu\text{m}$  as a cathode member to increase the conductivity of the cathode, that is to say, to increase conductivity of the sulphur to react electrochemically in the battery. Hence, sufficient conductivity is imparted to sulfur and there is no obstacle to the diffusion or transport of the reactive substances and products, thereby overall battery performance is enhanced. (*Emphasis added*→) Furthermore, the JP'431 publication and Moss et al share the same field of endeavor as they both address and disclose alkali metal-sulfur based batteries, and their related technologies. More importantly, Moss et al emphasize that the preferred cathode configuration uses a porous carbon cloth structure; otherwise if the resulting structure is not porous enough, good electrolyte penetration is not obtained (COL 2, lines 38-45). Such a cathode configuration is the same electrode configuration being used by the JP'431. Therefore, Moss et al and the JP'431 face the same technical difficulty of enhancing the battery performance of alkali-sulfur based electrochemical batteries employing the same porous electrode structure containing therein an active sulfur material as an electrochemical active material.

Thus, it is emphatically contended that the JP'431 publication discloses that electrodes having the specified pore size are better conductor and can be used in electrochemical applications involving alkali-metal technology. Therefore, since the prior art directly teaches a sulfur containing cathode having a pore diameter of at least 10-15  $\mu\text{m}$ , and a specific



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embodiment with an average pore size of 8  $\mu$ m (EMBODIMENT 7) a prima-facie case of obviousness does exist. Applicants' attention is respectfully directed to ***MPEP 2144.05 [R-1] Obviousness of Ranges*** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim 191 USPQ 90*; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson 65 USPQ2d 1379*. Hence, the JP'431 publication directly teach the use of sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity.

As to the specific pore size as recited in claim 3, it would have been obvious to a skilled artisan at the time the invention was made to make Moss et al's positive active material by having the specific pore size of claim 3 because even though the JP'431 publication does not overlap or lie inside the claimed pore diameter a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metal Corp. of America v. Banner 227 USPQ 773*. Moreover, the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine a satisfactory and optimum pore diameter. *The JP'431 publication discloses that the porosity and the pore size per se are essential to increase the conductivity of the cathode. Therefore, the specific porosity and pore size are taught to be a result-effective variable, and the discovery of optimum of result effective variable in a known process is ordinarily within the skill of art. In re Boesh 205 USPQ 215 (CCPA 1980). Thus, applicant's arguments concerning this matter have been fully considered but are unpersuasive.*

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5. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moss et al 3532543 in view of the Japanese publication JP 47-028431 as applied to claim 4 above, and further in view of Kovalev et al 6652440.

Moss et al and the JP'431 publication are applied, argued and incorporated herein for the reasons above. However, the preceding prior art does not expressly disclose the specific particle size of the elemental sulfur.

Kovalev et al teach electroactive cathode materials for electrochemical cells (COL 1, lines 10-15) wherein the cathode materials comprise sulfur-sulfur bond such as elemental sulfur (COL 1, lines 43-50). It is disclosed that such cathode materials are useful in batteries employing alkali-metal anode, in particular, lithium or lithium-alloy anodes (COL 1, lines 35-53/COL 16, lines 64-67). It is further disclosed that in one embodiment, **the particle size of elemental sulfur is from 0.01 to 100 microns** (COL 5, lines 18-20/COL 12, lines 7-9). *It is noted that Kovalev et al's particle size range encompasses, at least, particle sizes up to 20 Tm, or 10 Tm or 5 Tm.*

In light of these disclosures, it would have been obvious to one skilled in the art at the time the invention was made to use the specific particle size of the elemental sulfur of Kovalev et al in the lithium-sulfur battery of Moss et al-the JP'431 publication as Kovalev et al teach that elemental sulfur having the claimed particle size is useful for making positive electrode of lithium-sulfur batteries because this particular positive electrode material exhibits satisfactory specific capacity in combination with a lithium anode. As a consequence, lithium-sulfur batteries employing elemental sulfur having the claimed particle size as positive electrode achieves high energy capacity and rechargeability by the electrochemical cleavage via reduction and reformation via oxidation of the elemental sulfur. *Hence, Kovalev et al directly teach the use of*

*elemental sulfur having a particle size within the claimed range. Therefore, since the prior art directly teaches that the particle size of elemental sulfur is from 0.01 to 100 microns, including at least from 0.01  $\mu\text{m}$  up to 20  $\mu\text{m}$ , a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim* 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson* 65 USPQ2d 1379. Hence, Kovalev et al directly teach the use of sulfur materials having a particle size within the claimed range.*

### ***Response to Arguments***

1. Applicant's arguments with respect to the rejected claims have been considered but are moot in view of the new ground(s) of rejection.
2. Having considered now totality of the English translation of the JP'431 publication and Moss et al's disclosure, the examiner further adds the following in support of the prima-facie case of obviousness.

**(EMPHASIS ADDED→)** The JP'431 discloses specific embodiments wherein the porous material of the disclosed electrode exhibits an average pore size (See EMBODIMENTS 1-7). Specifically, **EMBODIMENT 1** shows an average pore diameter of 20  $\mu\text{m}$ ; and **EMBODIMENT 7** also shows a pore diameter of 8  $\mu\text{m}$ . *Thus, the JP'431 shows a pore diameter with sufficient specificity; and an average pore diameter sufficiently close to the claimed range. Additionally, the exemplified average pore diameters disclosed in JP'431 (20 $\mu\text{m}$ - Embodiment 1; 240 $\mu\text{m}$ - Embodiment 1; 350  $\mu\text{m}$ - Embodiment 2; 170  $\mu\text{m}$ - Embodiment 3)*

*suggest the suitability of selecting any average pore diameter within the lower end of the entire disclosed range of 10-1000  $\mu\text{m}$ . Simply put, the JP'431 does not disclose, teach or suggest to select an average pore diameter higher than 350  $\mu\text{m}$  and/or a pore size greater than 200  $\mu\text{m}$ . Consequently, it is reasonable to conclude that the JP'431 at once envisages using an average pore size closer to the lower end of the disclosed range, namely, JP'431 at once envisages selecting an average pore size closer to 10  $\mu\text{m}$ . Stated alternatively, working embodiments of the JP'431 show preferences for average pore sizes and/or pore sizes lower than 350  $\mu\text{m}$  and/or 200  $\mu\text{m}$ , respectively. Particularly, working embodiment 1 uses an average pore size of 20  $\mu\text{m}$ .*

3. Applicant has further argued that Examples 1-6 correspond to preferred embodiments and, therefore, the JP'431 teaches away from employing pore sizes in the lower end of the 10-1000  $\mu\text{m}$  range because the lower end of the disclosed range in JP'431 appears to be a non-preferred embodiment. In this respect, a finding that the prior art as a whole suggests the desirability of a particular pore size need not be supported by a finding that the prior art suggests that the pore size claimed by the patent applicant is the preferred, or most desirable, combination. In other words, it is not required that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide motivation for the current invention. The question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making or selecting the claimed pore size, not whether there is something in the prior art as a whole to suggest that the combination is the most desirable combination available. As a result, applicant's argument regarding the preference of Examples 1-6 to discredit the lower end of the disclosed range in JP'431 is not sufficient to overcome this

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rejection, and therefore, the applied disclosure which also encompasses many other pore sizes is valid, and pertinent thereto.

4. Applicant has argued that the JP'431 only exemplifies pore sizes in Examples 1-6 not lying within the claimed range, in response to that, the examiner asserts that:

a) a reference is good not only for what it teaches by direct anticipation but also for what one of ordinary skill might reasonably infer from the teachings. *In re Opprecht* 12 USPQ 2d 1235, 1236 (Fed. Cir. 1989); *In re Bode* 193 USPQ 12 (CCPA 1976); *In re Lamberti* 192 USPQ 278 (CCPA 1976); *In re Bozek* 163 USPQ 545, 549 (CCPA 1969); *In re Preda* 159 USPQ 342 (CCPA 1968); *In re Van Mater* 144 USPQ 421 (CCPA 1965); *In re Jacoby* 135 USPQ 317 (CCPA 1962); *In re LeGrice* 133 USPQ 365 (CCPA 1962);

b) a reference is not limited to working examples *In re Fracalossi* 215 USPQ 569 (CCPA 1982);

c) non-preferred embodiments can be indicative of obviousness. *Merch & Co. v. Biocraft Laboratories Inc.* 10 USPQ 2d 1843 (Fed. Cir. 1989); *In re Lamberti* 192 USPQ 278 (CCPA 1976); *In re Kohler* 177 USPQ 399 (CCPA 1973); *In re Mills* 176 USPQ 196 (CCPA 1972); *In re Bozek* 163 USPQ 545 (CCPA 1969); *In re Meinhardt* 157 USPQ 270 (CCPA 1968); *In re Boe* 148 USPQ 507 (CCPA 1976); *In re Nehrenberg* 126 USPQ 383.

**(Emphasis supplied→)** In general applicant has also argued that the prior of record is silent about “the average pore size” and “the average particle size of element sulfur”. In doing so, applicant appears to put a lot of emphasis on the term “average” per se to the point of apparently arguing that “an average pore size (or particle size) can not be assumed from a disclosure of a range of pore sizes in a material”. However, while the examiner not necessarily disagrees with

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applicant's characterization of "average pore size" and "average particle size" as a single feature, the examiner strenuously contends that the present claim language makes no attempt to specifically and unequivocally characterizes "average pore size" and "average particle size" as such. For example, the recitation "an average size greater than or equal to substantially 5  $\mu\text{m}$  and less than and including 15  $\mu\text{m}$ " and "an average particle size of the elemental sulfur is greater than 0  $\mu\text{m}$  and is up to 20  $\mu\text{m}$ " fully include a range within which the "average" size can lie. Although that language may meet section 112 requirements for purpose of definiteness, certainly, it opens the possibility of including "a range within the average range" [*sic*] of the particle size or pore size. Therefore, while applicant's characterization of the average pore size or particle size may be correct, such a characterization in no way is reflected in the present claims. All in all, applicant's recitation of "an average size lying within a claimed range" can be reasonably construed as essentially claiming different particles sizes rather than an average size as a whole. Simply put, an average size does inherently includes a distribution of different sizes which in average produces a "specific average size"; nonetheless, having a range for an average size does not strictly translates into having only one specific average size, actually, it might be translated into having a size range for multiple pore/particle size distributions, and/or a range for specific particle/pore sizes. Which one is applicant intending to recite? This is certainly unknown at this point and based on applicant's arguments. To that effect, a reasonable interpretation of the present claim language (not even the broadest reasonable interpretation) may lead a skilled artisan in the art to understand that applicant's claimed "average size" is not actually making reference to the average size per se, but simply to a pore size of between 5  $\mu\text{m}$  and 15  $\mu\text{m}$ ; and a particle size ranging from 0  $\mu\text{m}$  to 20  $\mu\text{m}$ .

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6. In this case, it is noted that, at least, one of the two end point of the JP'431 (*i.e.* 10  $\mu\text{m}$ ) constitutes a valid data point and thus it fully encompasses the claim as the end point represents a specific disclosure of a discrete embodiment of the invention disclosed by the prior art which amounts to a complete description and, therefore, an anticipation of the claimed range. **See Ex Parte Lee 31 USPQ2d 1105.**

7. With respect to applicants' arguments that "there is no expectation s to which element of this large range would achieve best conductivity, nor an invitation to explore pore diameters below 10  $\mu\text{m}$  or above 1000  $\mu\text{m}$  (*i.e.* in reference to the teachings of the JP'431)", the examiner contests that given that the JP'431 publication directly teaches a sulfur containing cathode having a pore diameter of at least 10-15  $\mu\text{m}$ , a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379. Hence, the JP'431 publication directly teaches using sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity. Moreover, having presented reasonable ground of rejection based on the teachings of such Japanese publication (*i.e.* the JP'431 publication), it is contended that the JP'431 publication discloses that it is essential to use a porous conductor [in sulfur containing cathodes and batteries] consisting of a material having a degree of porosity with pore diameters of 10-1000  $\mu\text{m}$  as a cathode member to increase the conductivity of the

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cathode. As a result, the examiner has presented reasonable and justifiable evidence to maintain that that the prior art certainly imparts criticality to the pore diameter.

8. As to the assertion that “Kovalev et al suggest multiple particle sizes for elemental sulfur, including particles from 0.01 to 100 microns, but Kovalev et al does not suggest which particle size should be used within this broad range, or which portion is advantageous to use”, the examiner again contests that given that Kovalev et al directly teaches that the particle size of elemental sulfur is from 0.01 to 100 microns, including at least from 0.01  $\mu\text{m}$  up to 20  $\mu\text{m}$ , a prima-facie case of obviousness still exists. Applicants’ attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379. Hence, Kovalev et al directly teach the use of sulfur materials having a particle size within the claimed range.

9. As to the specific pore size as recited in claim 3, it is stated that a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties.

*Titanium Metal Corp. of America v. Banner* 227 USPQ 773. Moreover, the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine a satisfactory and optimum pore diameter. The JP’431 publication discloses that the porosity and the pore size per se are essential to increase the conductivity of the cathode.

Therefore, the specific porosity and pore size are taught to be a result-effective variable, and the discovery of optimum of result effective variable in a known process is ordinarily within the skill



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of art. In re Boesh 205 USPQ 215 (CCPA 1980). Thus, applicant's arguments concerning this matter have been fully considered but are unpersuasive.

10. With particular respect to applicants' arguments regarding the broad range (including both the pore diameter range and/or the broad particle size range of Kovalev et al), the examiner now categorically contends that the JP'431 publication positively discloses such cathodes having the specific pore size are better conductor (conductivity is increased) and can be used in electrochemical applications involving alkali-metal technology; in addition, it is also stated that Kovalev et al directly teach the use of elemental sulfur within the claimed particle size. Hence, since the prior art of record directly teaches a sulfur containing cathode having a pore diameter of at least 10-15  $\mu\text{m}$  (*regardless the entire disclosed range from 10-1000  $\mu\text{m}$* ) and elemental sulfur having a particle size ranging from 0.01-100  $\mu\text{m}$ , a prima-facie case of obviousness still exists. Applicants' attention (**emphasis added**) is respectfully directed to ***MPEP 2144.05 [R-1]*** ***Obviousness of Ranges*** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim* 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson* 65 USPQ2d 1379. In particular, the JP'431 publication directly disclose the use of sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity; and Kovalev et al's particle size range encompasses the claimed one.

11. In the event that applicants further argue that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some

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teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the JP'431 publication and Moss et al share the same field of endeavor and/or at least are pertinent to the particular problem with which the applicant was concerned as they both address and disclose alkali metal-sulfur based batteries and their related technologies.

12. As to the assertion that the prior art “does not suggest advantage to any of these ranges as evident from Figures 4 and 5 and Tables 1 and 2 and paragraph 0023 and 0024” and that “applicant’s range imparts a novel feature as compared to the general conditions suggested in the existing art”, it is noted that applicants’ results show that the particular range is critical for a particle size of 5  $\mu$ m only. For example, EXAMPLES 1-4 show the use of particle sizes of 5  $\mu$ m only (SEE EXAMPLES 1-4). Further, Applicants are also comparing EXAMPLES 1-4 having a particle size of 5  $\mu$ m with COMPARATIVE EXAMPLES 1-2 having particle sizes of 30  $\mu$ m and 15  $\mu$ m, respectively. Thus, as apparently admitted by the applicants, there is no unexpected result for the claimed range of particle sizes greater than about 15  $\mu$ m. In addition, the results of Tables 1-2 of which applicants claim to show unexpected results are only commensurate with the specific particle size of 5  $\mu$ m. Hence, applicants have failed to provide objective evidence establishing the advantage of particle sizes throughout the entire claimed range (i.e. greater than or equal to 5 and less than and including 15  $\mu$ m). Thus, it is considered that particle sizes immediately below about 5  $\mu$ m and greater than 5  $\mu$ m (i.e.  $0 < \text{particle size } (\mu\text{m}) < 5$  and  $5 < \text{particle size } (\mu\text{m}) < 15$ ) has no effect on the life cycle of the resulting battery. Therefore, since the prior art directly teaches particle sizes greater than 5  $\mu$ m, a prima-facie case of obviousness

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still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lie inside a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Raymond Alejandro  
Primary Examiner  
Art Unit 1745



RAYMOND ALEJANDRO  
PRIMARY EXAMINER  
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